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Research on Texture Based Twins Face Identification by Using Hybrid LBP-LTP and Gabor-LDA Scheme with Gray Level Co-occurrences Matrix

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***Abstract*: The identical face recognition system needs to be able to function even when similar-looking individuals are detected, or in the unlikely event of identical twins. In this article, authors introduce a strategy for face identification called the GOL texture feature method that combines the GLCM over LBP. The PCA is used in traditional research works for feature extraction, although higher efficiency is not achieved. The drawback was that the linear PC always presents the data in fewer dimensions than the standard PCA. There are times when non-linear principal elements are necessary. When performed to the information, standard PCA won't be able to identify a good sample orientation. In order to resolve these constraints, ongoing research is done employing a clustering-based classification approach in so that solid conclusions. The drawback of clustering-based classifier is that they only accomplish categorization on data samples that exactly match the ones being evaluated. As a result, pattern matching for other situations is not performed. In contrast to the current methods, it is evident that the implemented suggested scheme, LBP-SVM, yields 100% outcomes for detecting face recognition.**

***Keywords*: Face recognition, Identical Twins, Hybrid LBP-LTP, GLCM.**

I.INTRODUCTION

The face detection technology is now often used in day-to-day living. Due to the distinctive characteristics of every human face, face recognition systems are frequently utilized in security systems. The facial recognition method does, however, have significant flaws, like image spoofing. An exploit known as facial image spoofing uses implanted images to trick the face detection system. Whenever anyone attempts to mimic a registered user by altering the facial image or exploiting such unauthorized access, this is known as a spoofing attack[1]. Without a way to recognize spoofing, the biometric authentication becomes weak.

Imprinted & original face features both reflect light differently. The imprinted face picture is a hard planar object while the actual face is a three dimensional object. The human face has color, whereas the imprinted facial image does not, and this is one of the other variances. We could devise a framework that could identify spoofing attacks on facial biometric systems using those variations.

One of the core areas of study in computer vision is texture characterization, which is crucial for both pattern recognition and classification. For classification tasks, content-based image retrieval, 3D image reconstruction, segmentation techniques, texture analysis is commonly utilized. Many studies have employed texture evaluation to find spoofing attempts in facial biometric systems. LBP, Gabor Wavelet, Haboor Wavelet, HOG, and Spatiotemporal Local Binary Pattern[2T][3] were the techniques employed. The distinction between the early human face photographs and the imprinted face images was made using LBP's capability to extract visual features. GLCM, which can recover an image's contrast level, was another feature extraction technique used to detect spoofing.The degree of difference was used to identify between spoof and real photos. This study

analyses the effectiveness of two feature extraction techniques—Local Binary Pattern & GLCM to categories a picture into two groups, spoof & non-spoof. To extract the information needed to identify spoofing photos, researchers use the LBP and GLCM technique. While the LBP and GLCM both rely on texture characteristics, GLCM employs a statistical function to ensure that the extract result accurately captures the full range of image texture properties. In comparison to employing just one feature analysis, researchers anticipate getting a superior outcome by combining the LBP histogram and GLCM statistical function.

Identical twins, also known as monozygotic twins, are produced when a single egg is fertilized by a unique cell, resulting in the fertilized egg dividing into two. Identical twins always share the same sex and share the same genome. Contrarily, fraternal (dizygotic) twins arise when two distinct eggs are fertilized by two various sperm during the same pregnancy. Like other siblings, they share 50% of their genes. Fraternal twins might not share the same sex or look alike. Numerous older research used twins to try to determine how hereditary a health condition was. In other words, both identical & non-identical twins would be examined in these investigations. The query was: Does each twin also have the disease if one twin does? Scientists may attempt to determine how much genetics was responsible for that specific medical condition by analyzing these rates among identical & non-identical twins. In genetics, siblings have thus long held a particularly important position.

The organization of the article is arranged as obeys. In section II presents the Local Binary pattern.Section III contain the GLCM. Section IV gives the literature Survey. Section V contains the problem formulation and objectives. Section VI contains the results and discussion part. Finally, section VII ends the paper with conclusion followed by references.

II.LOCAL BINARY PATTERN

In a number of applications, such as texture classification &segmentation, image retrieval, or surface examination, LBP features have excelled. Through Thresholding the 3-by-3 neighborhood surrounding every pixel with its centre pixel value & employing the outcomes as a binary form, the actual LBP operator identifies the pixels of a picture. A LBP computation example is shown in Figure 1.

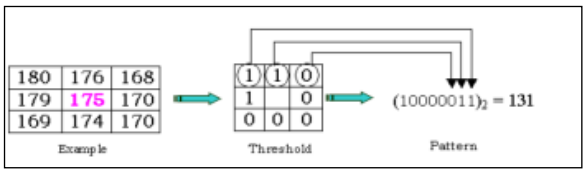

Figure 1.Illustration of LBP calculation [4]

A picture's tags generated across a 256-bit distribution could be utilized as a texture descriptor. Every histogram bin (LBP code) could be thought of as a little texture. These containers codify many kinds of curved edges, spots, flat surfaces, and other local primitives. Illustrations are demonstrated in diagram 2.

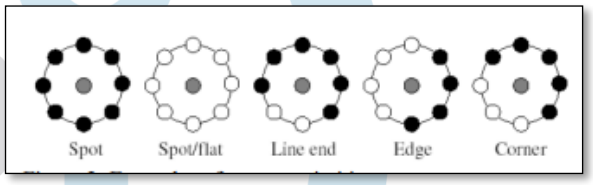

Figure 2. Examples of texture primitives[4]

Varying neighbor sizes are now taken into consideration by the LBP operator. As an illustration, the operators LBP4, 1 employs four neighbors, while LBP16, 2 takes into account sixteen neighbors on a radius of two. A neighborhood dimension of P evenly spaced pixel on a circle of radius R that constitutes a collection of circularly symmetric neighbors is generally referred to by the operators LBPP, R. In accordance with the 2P distinct binary patterns that could be built by the P pixels in the neighbor set, LBPP, R generates 2P distinct correct output. It has been demonstrated that some bins have a high data density than others. As a result, only a portion of the 2P LBPs can be used to represent the textured images.These basic patterns were described by [5] having a limited amount of bitwise variations from 0 to 1 & vice versa. For instance, the transition between 00000000 & 11111111 is zero, but the transition between 00000110 and 01111110 is two, and so on. An LBP description is produced by grouping patterns with much more than two transitions into a single bin. The toleration for monotonic illumination changes and computation efficiency of LBP characteristics are its key characteristics.

III.GLCM

The technique for analyzing textures has advanced significantly in recent years and could be splitted into 4 groups: statistical, geometrical, model-based, signal analysis. Despite various statistical techniques, GLCM has been demonstrated to be one of the most successful methods to texture evaluation[5]. The spatial distribution of an image's grey value and the frequency of grey occurrence pattern at particular angles and distances are both described by GLCM. GLCM can be used for texture categorization and identification. Haralick[5] developed the GLCM for texture analysis.N is the grayscale significant limitations, and N is the length of the GLCM matrix. The values of the matrix elements on (i,j) are each determined using the source grayscale image's numerical pattern, which must include a specific pattern. The supplied pattern provides grey pixels I& j next to each other at angle & length d. The variable d denotes the separation between two adjacent grayscale pixels, while the variable denotes the length of the discrete angle (00, 450, 90 0, 1350). The usual angle value for GLCM.

IV.LITERATURE SURVEY

Geetha et al.,(2021) To identify the faces of students for tracking their actions during online investigations, a ML-based face detection & recognition device based on the SVM framework is created. By acquiring feature vectors from the input images, the system design aids in faster face identification. A few methods, including LBPH, Fisher faces, SIFT, SURF, could be used in conjunction with this technique to create high effective obtained results suggest capable of detecting faces in differing illumination conditions and light intensities. Various methods could also be used to gain better optimal values. CNN provide greater accuracy[6].

Guannan et al.,(2022) suggested a technique for combining SVM, MLP, and CNN into a single real-time face recognition program to enhance predictive performance. In particular, for the first step, we crawl the internet for information, procedure it into a 1-D array, as well as store it in the dataset. The database information can then be used to train models such as SVM, MLP, as well as CNN. Following that, authors combined the three methods to create the application as well as calibrate the camera to decrease deformation. Eventually, we use the Tkinter subsystem to create the application's front-end functionality. To verify the efficiency of the suggested approach, we contrast it to SVM, MLP, as well as CNN. The fused method has a 90% accuracy. In contrast, the SVM, MLP, and CNN accuracies are 60%, 70%, and 80%, in both. The outcomes shows that the fused approach conducts better the other 3 scenarios and has the potential to contribute to the creation of real-time face recognition system in the future[7].

Vengatesan et al.,(2019) The issue of differentiating IT images has been addressed using cutting-edge systems and procedures. GLCM as well as SVM techniques are most useful for detecting twins with every single distinct thought, and these processes could provide the foundation for recognizing twins by utilizing designs. The normal precision was 79.82% after two seconds of viewing the image incorporates. Designers see that increasing the review time fundamentally improves the level of coordination accuracy. The simulation result using the proposed methodology showed a good result for identical twins with correlation of r=1, which isn't difficult to distinguish utilizing other biometric advancement[8].

Ahmad et al.,(2019) To distinguish identical twins, research suggested a deep CNN with a triplet error function. Designers used a hybrid method that combined the deep CNN design, which understands an encoding from facial pictures into ES, as well as the triplet loss function, which evaluates the L2 distance among facial pictures intoES. The procured L2 distance indicates the level of similarity among corresponding faces. Designers used 2 distinct CNN architectures on proposed raw pixel pictures, as well as different methods to decrease over fitting, like dropout & batch normalization, as well as L2 regularization. Suggested technique has the highest mean validation accuracy of more than 87.2%[9].

Sujay et al.,(2017) For performance monitoring, the FERET as well as Yale databases are taken into account. Color to grayscale conversion as well as resizing are used for pre-processing. The Viola-Jones approach is utilized to remove the face portion of the image, and 15 rotations such as 0 degree as well as + & - 7 degrees are rotated before the image is split into 3x3 sub blocks for LBP application. To retrieve the final characteristics, the LBP histogram is produced.

The SVM classifier is utilized to determine whether or not a match exists. FAR, FRR, TSR, EER are relevant certification that are assessed. The maximum TSR value is 100%, as shown by the the tabulated results as well as graph. When the optimized Match Count is 10.8, the EER is 10.2%, & theTSR is 93.33% for the Yale dataset, which consists of various variants in image dataset. The achievement of the Yale database outperforms that of the FERET database[10].

V.PROPOSED OBJECTIVES

- **PROBLEM STATEMENT**

In social interactions, our concentration is mostly focused on faces. It is crucial in establishing individuality. The process of saving human visual experience in a computer is called face recognition, which is a subset of pattern classification. The largest and most important use for this strategy is recognition, sometimes known as the security or authentication goal. Numerous scientists have been engaged in this area of study for a long time. To upgrade the conventional approaches, numerous methods & methods, including PCA, LDA, or Gabor, among others, have been created. The traditional research works implements the PCA for feature extraction but it fails to achieve higher efficiency. The Drawback was that the standard PCA always finds linear principal elements to present the information in small dimension. Sometime, we require non-linear principal elements. Standard PCA won't be able to identify a suitable sample direction when applied to the information. Therefore, using a clustering-based classification method, continual research is carried out to produce better findings in order to address these limitations. The disadvantage of clustering based classifiers is that it performs classification only for those data samples that are exact match for the tested ones. Thus it fails to perform pattern matching for other cases.

- **OBJECTIVES**

1. To implement the concept of extraction region of interest (ROI) to input image.

2. To implement the hybrid LBP-LTP to replace the traditional GLCM feature extraction process.

3. To implement Tree Based Classifier to perform classification.

4. To perform the comparison analysis between proposed and traditional faces recognition system.

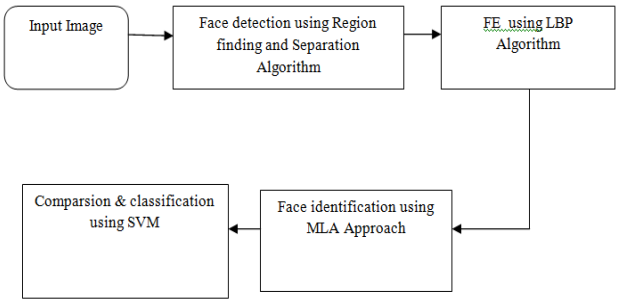

Figure 3: Flowchart of the proposed Work

VI.RESULTS

Face recognition from video has attracted much attention in recent years due to a variety of commercial as well as law enforcement apps, like surveillance technology, closed circuit television (CCTV) monitoring etc.. The human face is a distinct feature that can be seen in photos, videos, documentaries, and other media. The human face is the most significant biometric trait that is typically investigated in surveillance systems. It has been observed that there is low or no restrictions on the number, position, size,& orientation of human faces in video frames in video datasets. Furthermore, these video frames typically have cluttered background video, making it a difficult task where illumination, subject location, noise condition, face, and so on vary substantially from one video sequence to the next. As a result, human face recognition and detection in dynamic environments, such as Three aspects are identified when analyzing face recognition techniques: accuracy, sensitivity, and precision.

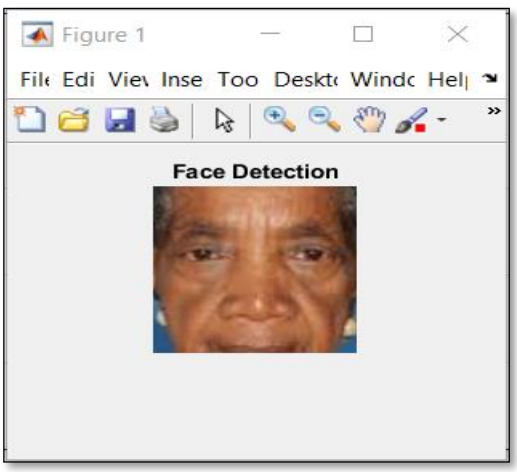

Figure 4:Face Detection

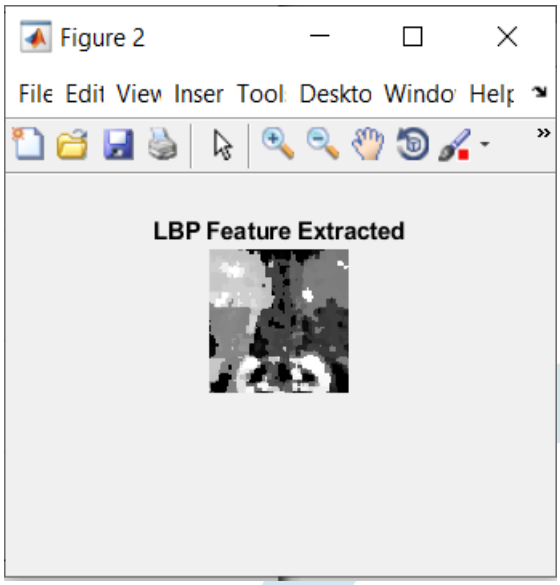

Figure 5: LBP Featured Extracted

The LBP descriptor is utilized, which is particularly useful for texture evaluation. The LBP descriptor categorizes the captured face into blocks & computes a histogram for everyone. As a result, each block histogram is aggregated and then merged. The constructed histogram of the entire face is contrasted to another face histograms to determine the degree of similarity among faces. Spoof faces would not have histograms that are similar to real faces. This aids in the detection of Spoof face.

- **Accuracy**

Accuracy refers to a device's ability to assess an exact value. In other words, it is the measure's resemblance to a basic or true value.

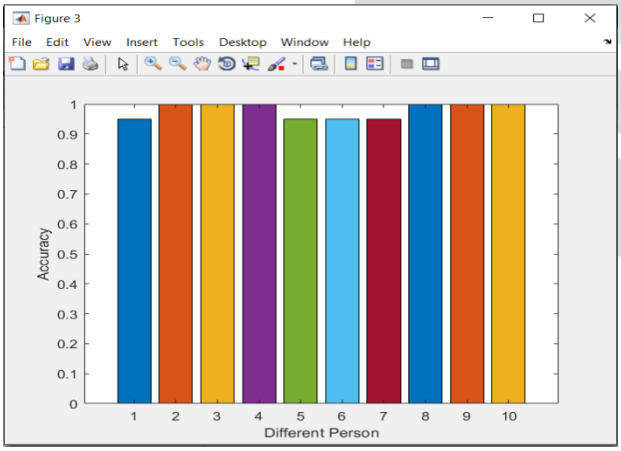

Figure 6: Accuracy for Different Person

- **F-measure**

The HM of recall & precision is called F-Measure. Precision & recall are balanced in the calculation done by the F-measure.

$$\textbf{F-measure} = \frac{2*\textbf{recall}*\textbf{precision}}{\textbf{precision}+\textbf{recall}}$$

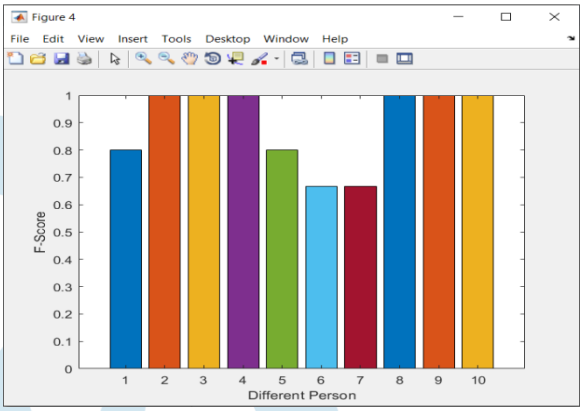

Figure 7: F-Score for Different Person

- **Precision**

The two measures that are frequently used to assess performance in text mining and also in text processing fields like knowledge discovery are precision & recall. Both correctness & fullness are gauged using these characteristics.

$$\textbf{Precision} = \frac{\textbf{TP}}{\textbf{TP}+\textbf{FP}}$$

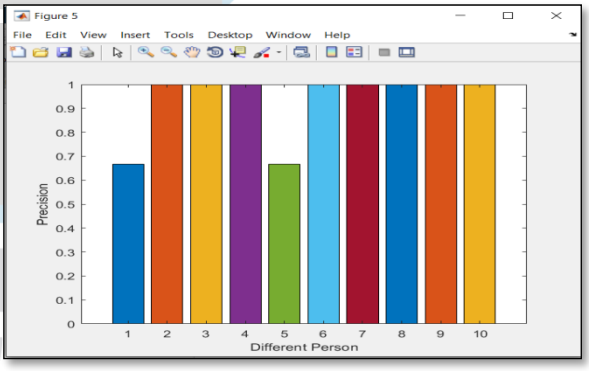

Figure 8: Precision for Different Person

- **Recall:**

The proportion of all the occurrences that were correctly identified as belonging to the PC to all the actual members of the positive class is known as recall. In other terms, it reveals the proportion of positive examples that were properly categorized out of the total positive examples.

$$\text{Recall} = \frac{\text{True Positive}}{\text{True Positive+False Negative}}$$

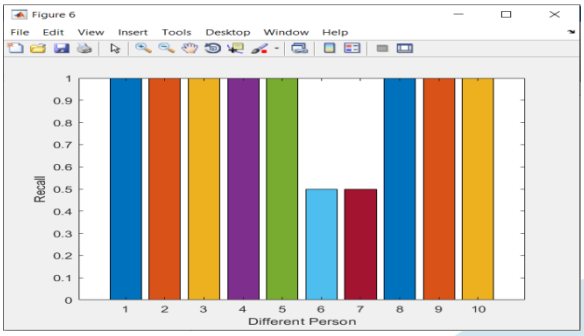

Figure 9: Recall for Different Person

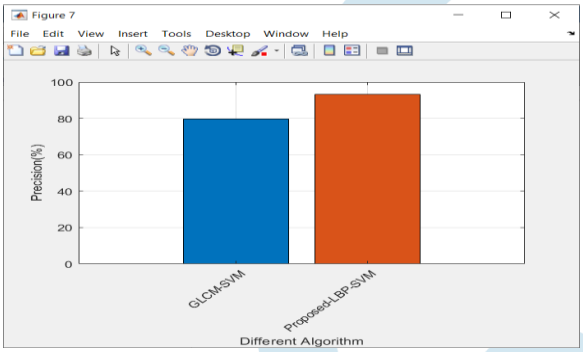

Figure 10: Precision for Different Algorithm (GLCM-SVM, Proposed LBP-SVM)

From Figure 10 its clearly shows that the implemented proposed approach LBP-SVM gives 100 % results to detect the face recognition as compared to the existing techniques.

VII. CONCLUSION

The various problems with face recognition systems are presented in this study, along with various approaches to solve them by providing methods that have been explored in the field. substitute the traditional GLCM feature extraction procedure with the hybrid LBP-LTP. The LBP description, which is especially helpful for evaluating texture, is used. The findings clearly show that, in contrast to the current methodologies, the actual suggested technique LBP-SVM provides 100% outcomes to identify face recognition.

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